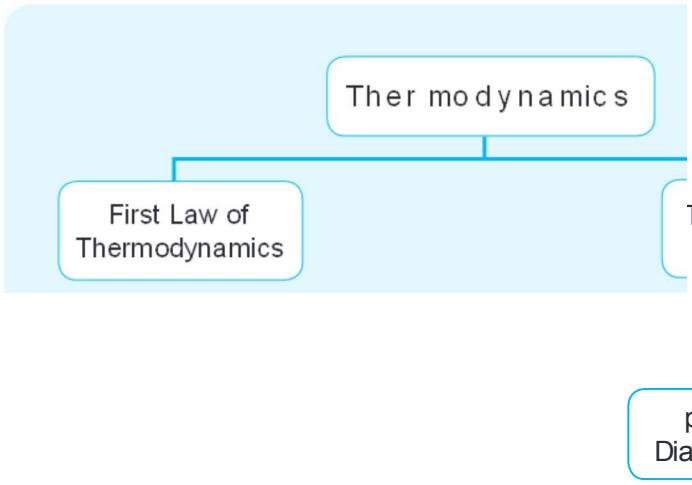
15 Thermodynamics

INTRODUCTION

Historically, thermodynamics has been explored in order to increase the efficiency of the early steam engines. Thermodynamics is a field of study that deals with energy transformation in a system (normally gas) and thermodynamic processes to change the temperature, volume and pressure of the system.

CHAPTER OVERVIEW



15.1 First Law of Thermodynamics

LEARNING OUTCOMES

You should be able to:

- Distinguish between thermodynamic work done on the system and work done by the system.
- State and use the first law of thermodynamics, $Q = \Delta U + W$.

Internal Energy, U

- The internal energy of a system is the sum of energy content of the system.
- The internal energy of a system is due to the motion of the molecules.
- By kinetic theory of gases, the internal energy is dependent on its temperature only.
- The system can increase its internal energy by absorbing heat or/ and work done ON the system by the environment.
- The system will decrease its internal energy by losing heat or/ and work done BY the system to its environment.

Work Done, W

- Work is done when there is a change in volume of the system, $W = p\Delta V$.
- The work done is positive if the work is done BY the system when it increases its volume.
- The work done is negative when the work is done ON the system by reducing the volume of the system.
- For a change in volume, ΔV due to a constant pressure p, the work done, $W = p\Delta V$.

Heat, Q

- Heat is the thermal energy that flows when there is a difference in temperature.
- Heat flows from higher to lower temperature region.
- Heat is positive if it flows into the system.
- Heat is negative when it flows out of the system.